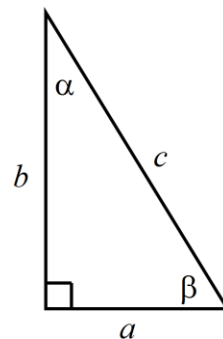


7.3 Application Problems using Trigonometry Notes

Solving Right Triangles

Finding all the missing angle measures and side lengths of a triangle is called “solving a triangle”. In a right triangle, we usually name the acute angles α and β (beta) and the lengths of the sides opposite those angles a and b , respectively. The 90° angle is γ (gamma) and the length of the side opposite the right angle (the hypotenuse) is c .



- If you know the lengths of two of the sides, use the Pythagorean Theorem to find the length of the third side.
- If you know the measure of one of the acute angles, use the fact that the angles in a triangle add to 180° to find the measure of the other angle.
- If you know the measure of one angle and the length of one side, use \sin , \cos , or \tan to figure out the lengths of the other sides.
- If you know the lengths of the sides and need to figure out the angle measures, use inverse functions (\sin^{-1} , \cos^{-1} , or \tan^{-1}).

Examples:

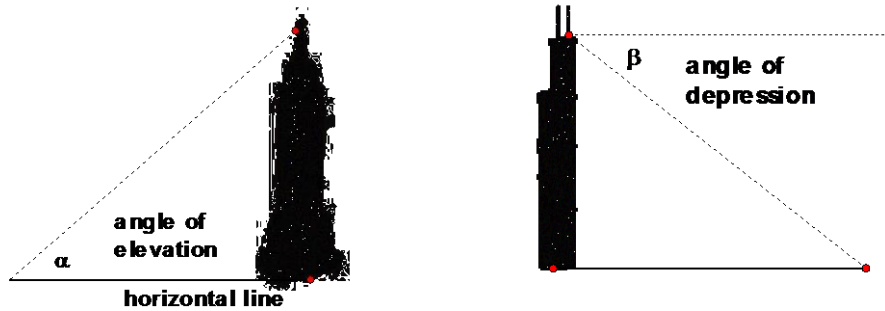
Solve the right triangle in which $\alpha = 60^\circ$ and $c = 2$.

Solve the right triangle in which $a = 2$ and $b = 5$.

Solve the right triangle in which $\beta = 20^\circ$ and $b = 15$.

Solve the right triangle in which $a = 5$ and $c = 13$.

Using trigonometry, we can find the size of an object without actually measuring the object. Two common terms used in this regard are **angle of elevation** and **angle of depression**.



Examples:

The angle of elevation of the top of a cell phone tower is 38.2° at a distance of 344 feet from the tower. What is the height of the tower?

At one location, the angle of elevation of the top of an antenna is 44.2° . At a point that is 100 feet closer to the antenna, the angle of elevation is 63.1° . What is the height of the antenna?

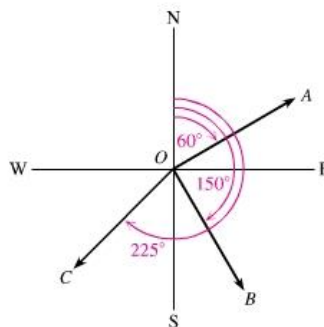
Bearing: The measure of an angle that describes the direction of a ray is called the bearing. Bearing is the clockwise angle from due north.

Another way to express bearing is to describe the acute angle that the ray makes with a ray pointing due north or south. For example:

N60°E is a bearing of 60° east of north

S30°E is a bearing of 30° east of south

S45°W is a bearing of 45° west of south

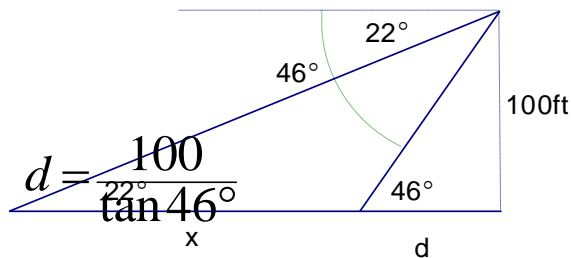


Lookout station A is located 15 miles due west of station B. The bearing of a fire from B is N 38° W and the bearing from A is N 65° E. Which station is closer to the fire? How much closer?

From the top of the 100 ft. tall Altgelt Hall a man observes a car moving toward the building. If the angle of depression of the car changes from 22° to 46° during the period of observation, how far does the car travel?

From the smaller right triangle:

$$\tan 46^\circ = \frac{100}{d}$$



From the larger right triangle:

$$\tan 22^\circ = \frac{100}{x+d}$$

$$x+d = \frac{100}{\tan 22^\circ}$$

$$x = \frac{100}{\tan 22^\circ} - d$$

$$x = \frac{100}{\tan 22^\circ} - \frac{100}{\tan 46^\circ} \approx 150.9$$

So, the car travels about 151 feet.

A dog is watching two cats. The angle between the lines of sight to each cat is 59° . The distance from the dog to one cat is 51 ft. The distance from the dog to the other cat is 67 ft. How far apart are the cats?